The Role of Research in International Tobacco Control

Kenneth E. Warner, PhD

The future of the tobacco-produced disease epidemic rests in low- and middle-income countries, where cigarette sales are growing—the result of rising incomes, trade liberalization, liberalization of the treatment of women, and the introduction of Western-style advertising.

Research on disease causation, epidemiology, and educational and policy interventions has contributed significantly to reducing smoking rates in developed countries. A similar contribution is needed in less affluent nations, but severe challenges are involved in implementing a robust research program in such countries.

In an attempt to understand these challenges and begin to conceptualize an approach to overcoming them, I examine the need for and methods to achieve a program of meaningful research on tobacco and health, as well as health policy, in the developing world. (*Am J Public Health.* 2005;95:976–984. doi:10.2105/AJPH.2004.046904)

Tobacco has entered the era of globalization. The business of selling cigarettes and, hence, the business of tobacco control, inevitably has joined Big Macs, MTV, Toyotas, and even terrorism in playing to an international audience. The major multinational tobacco companies function in scores of countries around the world. The economic future of the industry rests in low- and middle-income countries, where rising incomes, trade liberalization, liberalization in terms of the treatment of women, and the widespread introduction of sophisticated Western-style advertising ensure a thriving future for cigarette sales. The tobacco disease epidemic will thrive there as well. Consequently, the future of tobacco control must also reside in the developing world. The existence and prominence of the Framework Convention on Tobacco Control (FCTC)—the World Health Organization's (WHO's) first-ever use of its international treaty-making authority—demonstrate that the world's health leaders clearly envision that future today.[1]

Although not entirely oblivious of the need, researchers have been less adept at shifting from a nearly exclusive focus on developed countries toward one that encompasses issues pertinent to the spread of tobacco in developing nations as well. Creation of a robust developing country research program confronts a number of severe challenges. Here I strive to convey an understanding of these challenges and begin to conceptualize an approach to overcoming them. I address the need for and methods to achieve a program of meaningful research on tobacco and health and health policy in the developing world.

After an overview of the magnitude and nature of the global tobacco epidemic, I discuss a framework for thinking about the stages of research in a global tobacco control context. I then briefly contemplate the historical role of nicotine and tobacco research and identify the domains of research that seem to be particularly critical for the future of international tobacco control. Next, I consider how research findings might make important contributions to global tobacco control and discuss obstacles that temper this potential.

A number of existing international database resources facilitate development and application of useful research. I identify these resources and then turn to the need to expand research capacity in the world's poorest countries. In addition, I address the challenge of generating interest in and use of research. I close with some comments on the role of research in the formulation, development, and eventual implementation of the FCTC.

THE GLOBAL TOBACCO EPIDEMIC

By now, the figures are numbingly familiar to most students of tobacco control. Primarily, but not exclusively, through the vehicle of cigarette smoking, tobacco kills 5 million people each year.[2] Half die during the productive period of middle age (35–69 years).[3] Half of tobacco-related deaths occur in developed countries, with the remainder occurring in nations in which, until recently, we considered chronic disease an irrelevancy, the result of the toll of infectious disease. High rates of heart disease, cancer, and other debilitating chronic conditions in developing countries have put the lie to this now-dated conventional wisdom.

Sometime during the next 20 to 25 years, tobacco's global death toll will double to 10 million annually, when smoking will become the leading preventable cause of death worldwide, as it is in developed countries today. By the year 2030, tobacco will exact fully 70% of its victims from the world's poor and middle-income nations. At that time, tobacco will kill more of the globe's citizens than all of the following combined: AIDS, tuberculosis, automobile accidents, homicide, suicide, and childbirth.[2–4] Tobacco, it should be noted, has been implicated in increasing the epidemic of tuberculosis in developing countries.[5]

Widespread cigarette smoking did not begin in the developed countries until the 1910s, and it has only recently begun in many of the world's poorest nations. The consequence is that, during the 20th century, tobacco killed "only" 100 million people. "Only" sounds ludicrous in the context of a number so unimaginably large. Yet, WHO estimates that the current global total of 1.2 billion smokers will rise to approximately 1.6 billion by 2025 (reflecting population growth as well as increases in smoking rates among women in developing countries) and that the death toll will grow by an order of magnitude: in the 21st century, an astounding, and terrifying, *1 billion people* will die as a result of tobacco consumption.[2,3]

Why are there so many tobacco-produced deaths? A principal reason is that so many

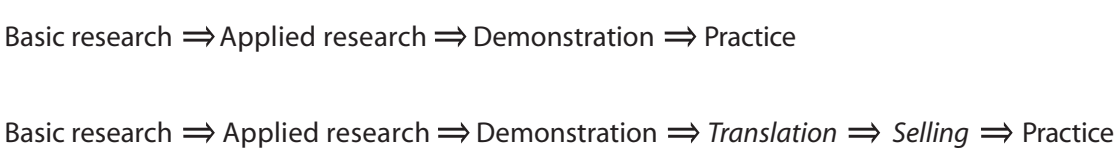

FIGURE 1—The traditional continuum from basic research to standard practice (top) and the modified version of the continuum (bottom).

people smoke. Worldwide, nearly a billion men are cigarette smokers, including 35% of men in developed countries and 50% of men in developing countries.[3] China alone boasts 300 million male smokers, nearly a third of the global total (and more than the entire population of men, women, and children, smoking and not, in the United States). The good news, if one can find it in such depressing figures, is that male smoking rates have peaked and are declining, albeit slowly, in both developed and developing countries.

Approximately 250 million women are smokers, including 22% of women in developed countries and 9% of women in developing countries.[3] Smoking prevalence rates among women are declining in many, but not all, developed countries. In developing countries, in contrast, the tendency, and the prospect for the future, is for prevalence rates to rise. Indeed, as women gain affluence and freedom from traditional restraints on their behavior, the likelihood is that smoking rates will climb dramatically. Consider, for example, the potential market in China, where smoking among women remains rare. There can be little doubt that the multinational cigarette companies eagerly contemplate the prospect of the market that will be created by the economic and social liberation of women.

After rising rapidly throughout the 20th century, global cigarette consumption appears to have leveled out over the past decade, the result of a delicate balancing act between declining consumption in the affluent nations and rising consumption within the poor nations. It is virtually impossible, however, to arrive at a precise estimate in light of the enormous amount of cigarette smuggling that characterizes the international market. (Up to 30% of legally exported cigarettes are never legally imported anywhere.[6]) Aggregate consumption is estimated at the remarkable figure of *5.5 trillion* cigarettes per year.[3] That works out to nearly 1000 cigarettes per year for every man, woman, and child on the planet, or *3 per day for every human being.*

These staggering figures constitute the background, and the motivation, for the work that confronts the field of tobacco control. To contemplate the ways in which research can contribute to this task, I begin with a framework.

STAGES OF RESEARCH: A FRAMEWORK

The top row of Figure 1 presents a common conceptualization of how research evolves from its most basic form to practical changes in society. This conceptualization reflects how major public research agencies, such as the National Institutes of Health, perceive their job. They support basic research with the hope that useful applied research will derive from it. Applied research successes often then merit demonstration projects, with the expectation that successful demonstration will lead to widespread practice.

As tobacco control professionals appreciate, this seemingly irresistible logic is often resisted in the real world. To take 1 obvious example, smoking cessation treatment is well established as a highly cost-effective health care intervention.[7,8] Yet today, a sizable fraction of managed care organizations in the United States do not include cessation treatment as a covered service, while many others afford their members only very limited coverage.[9] In 2001, 14 states did not cover any cessation services for their Medicaid populations, while only a single state covered all of the counseling and drug therapies recommended by the Public Health Service guidelines on smoking cessation.[10,11] There are numerous reasons for this less than complete coverage, but 1 is that, even today, many health system decisionmakers do not believe that smoking cessation treatments are sufficiently effective to warrant coverage.[12]

One plausible reason applied research so often fails to be translated into widespread practice is that the depicted research continuum is missing 2 important steps, as depicted in the bottom row of Figure 1. The applicability of applied research must be effectively conveyed and sold to individuals charged with making innovation adoption decisions. Often, this means that the case for the innovation must convince the lay public as well, because the public can create the demand for the innovation that makes its adoption truly irresistible. In Figure 1, conveyance is depicted as "translation." Translation refers to the process of converting scientific findings (and scientific jargon) into language that can be readily understood—and appreciated—by decisionmakers and the lay public. "Selling" refers to the process of convincing decisionmakers that adopting the innovation is desirable. In tobacco control, as elsewhere, activist organizations frequently play a central role in "translation" and "selling," often in cooperation with the researchers who possess the relevant scientific expertise.

An example will clarify the nature and importance of "translation" and "selling." Determining that the price elasticity of demand for cigarettes in developing countries is −0.8 in itself conveys virtually nothing of value to public-sector decisionmakers in these countries. First the meaning of "elasticity of demand," and then the specific implications of an elasticity of −0.8, must be explained. In this instance, those charged with the translation function must explain that a 10% increase in cigarette price will cause the quantity of cigarettes demanded to fall by 8%. If the price increase is achieved through a tax increase—the most common cause of a price increase other than industry wholesale price increases—government tax revenues will rise, probably significantly, at the same time that smoking and its associated disease toll will fall. A cigarette tax increase can thus help

the government enhance the health of its citizens while doing well for its own treasury.[13] Such benefits need to be effectively and convincingly explained to governmental authorities, a combination of translation and selling.

In addressing a global audience, one can also point out, as did the World Bank in its 1999 report *Curbing the Epidemic: Governments and the Economics of Tobacco Control,* that a mere 10% increase in cigarette price throughout the low-income and middle-income countries of the world would decrease the number of smokers worldwide by 36 million and would decrease the number of smoking-produced deaths by fully 9 million.[14] Although these figures represent a small proportion of the total burden of smoking, they signify a most impressive public health achievement in absolute terms.

In dealing with tobacco use in low- and middle-income countries, the translation and selling functions are both more important and more difficult than they have proved to be in the developed world. In addition to the obvious difficulty of translating from English to another language filled with nuances, the social and cultural differences that define societies create enormous challenges in terms of "translation." For example, it has proven relatively easy to translate and sell research findings on the dangers of environmental tobacco smoke, as reflected in the adoption of clean indoor air policies in several developed nations, with more following daily. It may be far more difficult to do so in a developing country in which two thirds of all men smoke, as is not uncommon, and where smoking is considered a fundamental sign of adult masculinity. In addition, the interested public may consider other environmental exposures far more important.

The challenge is thus clear: how to ensure that research findings are relevant to the people who matter, namely the public, the press, bureaucrats, legislators, heads of ministries, and heads of state. The response to the challenge is not clear. This is where the "selling" function becomes crucial. That function involves marketing and lobbying skills employed, in the case of tobacco control, by experts from major nongovernmental organizations.

TOBACCO RESEARCH IN THE INTERNATIONAL CONTEXT

A moment's reflection will demonstrate that numerous bodies of research on tobacco and health have played essential roles in transforming global attitudes and policies toward smoking. Consider the fundamental examples outlined in the following.

Establishing the Link Between Smoking and Lung Cancer

First and foremost is the seminal research conducted in the 1950s on the epidemic of smoking and lung cancer. Researchers from both the United States[15–17] and the United Kingdom[18,19] produced powerful studies that dramatically changed the world's understanding of smoking as a causative factor in fatal illness. Those works, and tens of thousands of subsequent studies on the health consequences of smoking,[20] have altered the public health landscape in all but a handful of countries. Indeed, it is arguable that, in terms of both knowledge and impact, few bodies of research have had such a profound influence on global health. This work helped to change science itself: the interpretation of the then-existing epidemiological research in the first surgeon general's report on smoking and health in 1964[21] set the standard thereafter by which epidemiologists infer causality from statistical association.[22]

It is worthy of note, as well, that this example vividly illustrates the role of translation and selling in converting science into action. In the United States, the most dramatic early impact of the new research—the 20th century's first 2-year decline in adult per capita cigarette consumption in 1953 and 1954—immediately followed publication of an article in *Reader's Digest* titled "Cancer by the Carton."[23]

Developing Behavioral and Pharmacological Smoking Treatments

Work on finding both behavioral and pharmacological approaches to treating nicotine dependence has transformed how we think about and deal with nicotine addiction, especially in the developed nations of the world. The research of individual scientists in this area is directly responsible for helping hundreds of thousands of people quit smoking, thereby preventing many premature deaths. No individual clinician has had a comparable impact on health. A great challenge, discussed later, is how to make this important work more relevant to smokers in the poorest nations. (Indeed, the task of stimulating interest in cessation treatment among smokers in developed countries remains a significant barrier to progress.)

Determining the Effects of Environmental Tobacco Smoke

Research on the health effects of environmental tobacco smoke has contributed enormously to ridding public places and workplaces of environmental tobacco smoke, again thus far primarily in a subset of industrialized nations. In the United States, as a prominent example, numerous political jurisdictions, including well over 100 municipalities and more than half a dozen states, have completely prohibited smoking in all restaurants and bars.[24] Another body of research has supported this phenomenon: policy analyses showing that bans on smoking in restaurants and bars do not damage the affected businesses.[25]

Also indicative of the influence of epidemiological research is the dramatic growth in the number of private homes in which smoking is not permitted, including homes occupied by smokers.[26] The evolution of no-smoking policies within private homes undoubtedly also reflects the powerful impact of legal bans on social norms.[27] In the coming decade or so, the fruits of this research will be reaped in middle- and low-income countries as well. The developing country delegates to the FCTC negotiations understood the message of this research. It takes time to move policy and practice—frustrating, deadly time—but it *will* happen.

Assessing the Effects of Price on Cigarette Smoking

As a final example of the role of research in international tobacco control, consider analyses conducted by economists of the effects of cigarette price increases on consumption of cigarettes and, consequently, the health of the public. This research turned public health thinking on its head. Twenty-five years ago, it was heresy in public health

circles to suggest that one might use economic incentives such as increased taxation to decrease smoking rates. The public health community did not believe that such strategies would be effective—smokers, after all, were addicted. Furthermore, even if they were effective, many public health professionals believed it was inappropriate to use extrinsic incentives, such as taxes, rather than intrinsic motivations, such as the desire to preserve one's own health.

Yet a now sizable body of research on this subject,[28,29] beginning with the work of Eugene Lewit and his colleagues,[30,31] along with effective translation and dissemination of its message,[32] has fundamentally altered the practice of tobacco control.[33] Since the 1980s, increasing tobacco taxes has become a first principle of tobacco control policy. Indeed, today one might be accused of tobacco control heresy if one did *not* advocate tax increases as a prominent component of a comprehensive tobacco control policy. The efficacy of taxation as a cornerstone of tobacco control policy was never challenged at the FCTC negotiations. The importance of taxation as a tobacco control strategy is as recognized today by public health advocates in developing countries as it is in our own. In nations around the world, this body of economic research has saved lives and will continue to do so for generations.

Numerous other areas of research on tobacco control provide similar evidence of the contributions of research, including the estimated effects of cigarette marketing and of advertising bans, the impact of antismoking media campaigns, and the effectiveness of youth access interventions.[34] The examples presented here demonstrate vividly that the history of nicotine and tobacco research, especially when viewed over a sufficiently long time horizon, is one of enormous contribution to human welfare. The examples demonstrate, as well, the crucial role of the translation and selling functions depicted in Figure 1.

CRITICAL DOMAINS FOR RESEARCH

In 1999, a collaboration between Research for International Tobacco Control and WHO produced a report that identified the most important areas of research needed to address the global tobacco disease pandemic. Titled *Confronting the Epidemic: A Global Agenda for Tobacco Control Research,*[35] the report cited the following 8 themes: (1) country-specific research, (2) economic and legislative policy interventions, (3) program interventions, (4) treatment of tobacco dependence, (5) tobacco product design and regulation, (6) tobacco industry analysis, (7) tobacco farming, and (8) FCTC.

Given the generality of these themes, one might interpret the list as necessarily all encompassing. Still, it is helpful in describing a broad vision of needed research contributions differentiated by type. When it comes to applying the list to a specific country's tobacco epidemic, however, the devil is in the details. Where, for example, does one fit research on how to educate poor, often illiterate peasants about the dangers of tobacco consumption when their only exposure to the attributes of smoking is through billboards portraying affluent, successful people as smokers? Such research is complicated by other issues specific to developing countries. How, for example, would research factor in the reality that, quite logically, impoverished people may not think in terms of health consequences decades hence?

The list does not address questions such as how much research is needed in each domain in general or in the context of particular countries. Within the domain of country-specific research, for example, basic epidemiology on smoking prevalence and tobacco-related disease incidence would seem essential to establish the parameters of an individual country's tobacco problem. But how far should one go in evaluating the relationship between smoking and disease in a country-specific context? Arguably, there is no need for research on whether smoking causes lung cancer among Nigerians or North Koreans or Costa Ricans. Yet, the epidemiology of lung cancer in many middle- and low-income countries is such that the singular clarity of the smoking-and-cancer message in the industrialized world may not translate directly to the citizens of other countries.

For example, in China several years ago, epidemiologists found that smokers were 3 times more likely to have lung cancer than were nonsmokers.[36] In the United States, United Kingdom, and other developed nations, where most of the research has been conducted, smokers' risk of lung cancer is well in excess of 20 times that of nonsmokers.[20] What explains this apparent anomaly? Two important differences in the Chinese and developed country context provide an explanation. First, Chinese men do not have a long history of the pattern, often seen in the United States and United Kingdom, of smoking a pack or more a day since their teenage years. Their smoking is less intensive, the product of their poverty in large part, and they start smoking later in life, typically in their 20s.

Second, many of China's cities are plagued with levels of air pollution, including indoor air pollution, that Westerners cannot imagine. Pollution was probably causing lung cancer in many Chinese citizens both independent of, and synergistically with, smoking. In short, we may not need to study whether smoking causes lung cancer among the residents of China. However, understanding the nature of the epidemic of lung cancer in China *is* crucial to addressing the problem in the Chinese context.

Country-specific needs for treatment of tobacco dependence can vary dramatically depending on a country's stage of economic development and its smokers' beliefs about and attitudes toward smoking. Clearly, a serious challenge for the research community is how to develop behavioral and pharmacological treatments that will be desired by and affordable to smokers in the world's poorer regions.

One final example illustrates how needs vary from one country to another. In the developed country context, "product design and regulation" relates closely to the contemporary harm reduction debate concerning conventional and novel modified cigarettes.[37] But what does "product design and regulation" mean for India? India is a country in which well over a dozen distinct forms of tobacco consumption are engaged in by tens of millions of people.[38] One form, smoking bidis, may be more dangerous than conventional cigarette smoking. (Bidis are hand-rolled cigarettes that, in size and shape, resemble marijuana "joints.")

India suffers from 1 of the world's highest rates of oral cancer, quite possibly *the* highest rate, with oral cancer responsible for a large proportion of cancer deaths in the country. In contrast, oral cancer is a rare disease in most

of the world's most affluent nations. A significant proportion of India's oral cancer is attributable to nonsmoked oral tobacco use, again in multiple forms. Some oral cancer may be caused by such seemingly bizarre rituals as reverse chuta smoking, in which poor rural women smoke cigarlike tobacco products with the lit end inside their mouths. What does "product design and regulation" mean in the context of India's tobacco plague? How could one carry out the requisite product analysis and product use surveillance in a poor, complex, and diverse population?

The preceding examples merely scratch the surface of the research needs in regard to tobacco control in developing countries. However, these examples should indicate the importance of supporting such research.

PROMISE OF AND CHALLENGES TO RESEARCH

Research has clearly already played important roles in taming the tobacco epidemic worldwide, especially in industrialized nations. The prospects for further significant contributions are excellent—indeed, essentially inevitable—especially in the world's low- and middle-income countries. This does not mean that these contributions will come easily or quickly, although some probably will. Rather, it means that research will remain an essential component of the battle against tobacco-produced disease throughout the world.

Promise of Research

Before turning to the obstacles confronting research, I consider areas in which the promise of research is particularly high, especially in poorer countries. For example, in the domain of country-specific research, there is a clear need for basic epidemiology on patterns of tobacco use and estimations of the probable health implications over time. There is nothing more powerful than "personalizing" the tobacco epidemic message for countries that have thus far ignored it. Several organizations and individuals have led a valiant effort to develop such research, working closely with in-country scientists in a manner that produces epidemiological results while simultaneously building research capacity within those countries.[39–41] This is the kind of effort that has a clear direction, an almost certain payoff, and the assurance of reasonably near-term results. However, these characteristics do not mean that such an effort will be easy.

Research on the implications of policies, both country specific and global, offers an especially powerful return on investment. Globally, groundbreaking work on cigarette smuggling, including the involvement of the courts, is changing the way countries and the cigarette companies within them do business.[42,43] With approximately 30% of all exported cigarettes never legally imported anywhere,[6] the implications of smuggling for smoking are substantial. Smuggling lowers the price of cigarettes both directly (smuggled cigarettes are cheaper than the legitimate product because they escape taxation) and indirectly (the fear of smuggling and the crime that goes with it causes countries to keep their cigarette taxes lower than they might otherwise be).

Research on smuggling has already paid significant dividends, as witnessed by the case of Spain, a country in which smuggling was endemic just a few years ago, with an estimated 20% to 30% of the market consisting of smuggled cigarettes. Today, with Spanish authorities having taken the issue seriously, smuggled cigarettes constitute only 2% to 3% of total cigarette consumption, and the price of cigarettes in Spain is higher as well.[44]

Country-specific research on the public's responses to tax increases is another area crying out for attention. Knowledge about the effects of tax on price and the effects of price on consumption, while substantial in developed nations, is very limited in developing countries. The World Bank estimates the price elasticity of demand for cigarettes in developing countries at −0.8, approximately twice that observed in developed countries.[14] As described earlier, price elasticity of demand is a measure of how responsive the quantity of cigarettes demanded is to changes in cigarette price. It is calculated as the percentage change in quantity demanded divided by the percentage change in price that induced the change in demand. Thus, the World Bank's estimate that price elasticity is −0.8 in developing countries means that the demand for cigarettes in such countries falls by 8% when price rises by 10%.

A reasonable estimate, The World Bank's figure derives from studies in only a handful of countries, in contrast with the scores of studies from developed countries. It would be very useful to be able to differentiate elasticities by countries' income levels and the price levels of their cigarettes. Such knowledge would permit government authorities to estimate the public health benefits of increasing taxes and generate solid estimates of the revenue implications of a tax increase.[14,45,46] Given the power of price to modify smoking, likely to be especially important in poor countries, this is a vital area of future research. Several institutions have begun to support such research.[39,47]

Assessing how to communicate the dangers of tobacco use in poor societies is simultaneously a tremendous challenge and a great opportunity. This applies to communicating dangers directly to the public and to assisting policymakers in finding effective methods of message framing. Similarly, and equally important, researchers must determine how to disseminate the message about the health benefits of quitting smoking. This is no small task in countries in which media communications are limited and the tobacco industry has established its own media presence.

Related to this last point, it will be especially important for nicotine dependence researchers to find new ways of supporting cessation attempts at far lower costs than those that are acceptable in affluent nations. Much like the problem of delivering effective but inexpensive AIDS medications to the masses of HIV-positive Africans, we cannot hope to aid smoking cessation attempts in the poorest of countries with boxes of nicotine patches sold at $40 or more.

The *Global Agenda for Tobacco Control Research*[35] mentioned several research themes it characterized as "cross-cutting," including "country readiness" and "dissemination and application of research results." Research identifying the readiness of countries to learn about the dangers of smoking, and then to be ready to do something about them, could help international organizations focus resources on those countries where they would do the most good. As noted previously, assessing how to disseminate and apply research findings in different cultural contexts

is itself a research subject of momentous importance.

Obstacles to Progress in International Tobacco Control Research

The preceding examples illustrate opportunities for research to make important contributions to global tobacco control. However, these and other areas of research confront formidable obstacles. For instance, nearly all low- and middle-income countries possess neither adequate pools of research talent nor the internal resources—financial and institutional—necessary to support them. Although the data have yet to be analyzed, if they even exist, it seems highly probable that the number of nicotine and tobacco researchers and the financial resources available to them rise exponentially with countries' income levels. The world's richest country, the United States, probably has the largest percentage of population devoted to nicotine and tobacco research and certainly the most money and institutional infrastructure to support the effort. If one searches the entirety of a country such as Zimbabwe or Indonesia, in contrast, one will be hard pressed to find more than a handful of researchers and a paltry sum of money supporting them. Indeed, many middle-income countries have no personnel or resources specifically earmarked for tobacco control.

There is also an inadequate supply of developed country researchers, and inadequate funding, to support capacity development in developing countries. This is not to suggest that there are no such resources; to the contrary, as described by Kassel and Ross,[40] there are important exceptions. However, no tobacco control expert would question that rich country support of capacity development in poor countries is insufficient.

An obstacle of enormous proportions is the lack of political will, and frankly even interest, in tobacco control research in many poor countries. Tobacco control itself simply is not a priority in countries with vast underemployed and unemployed, poverty-stricken, disease-riddled populations. There is good reason that tobacco control *should* be a priority. Everyone understands the toll that AIDS will take on the productive capacity of numerous African countries. But few appreciate the toll that tobacco will take, given that half of all tobacco deaths occur during the working years of middle age. Still, it is readily understandable that, in the pressures of the present, tobacco control is a distant concern. This results in research on tobacco control being off the scientific radar in such countries. It may take a uniquely creative, resourceful, and energetic activist to champion the cause, as was the case in Thailand beginning in the 1970s. There Dr Prakit Vateesatokit mounted what was initially nearly a 1-man show that eventually led to Thailand's adopting numerous tobacco control measures, including an advertising ban, import taxes, ingredient disclosures, and strong health warnings.

In addition to reflecting the competing problems confronted by low-income societies, the lack of political interest in tobacco control research reflects a strong base of economic and political opposition to research that might be used to interfere with a thriving tobacco enterprise. The power and influence of the tobacco industry in affluent nations has been documented frequently.[48,49] In those countries, however, the industry faces significant, at least partially organized, opposition. In many low- and middle-income countries, officials at the highest levels of government have their hands buried deeply in the pockets of the industry, often without a pretense to the contrary.[50] The multinational tobacco companies spread their money around so effectively that any would-be opposition is doomed before it starts. In some countries, agricultural dependence on tobacco, much of it wrought by multinational company interventions, is substantial. In many countries, the principal tobacco company remains a national monopoly, a formal part of government and of the government's revenue stream. The world's largest tobacco company, China Tobacco, is itself a national monopoly.

If formidable obstacles confront the attempt to move global tobacco control research forward, they have not succeeded in suppressing all efforts to do so. In the next section, I consider resources, most relatively new, that afford an opportunity to make progress in this challenging but important domain.

EXISTING DATABASE RESEARCH RESOURCES

Several country-based and international organizations currently devote significant resources to research on global tobacco control, with an emphasis on low-income countries.[35,51] The fruits of their efforts are generally available to interested parties on the Web. Existing resources document everything from countries' smoking prevalence rates, by age and gender, to the nature and size of their indigenous tobacco industries. This section describes several of the most important database resources.

The National Tobacco Information Online System, with the convenient (and not accidental) acronym "NATIONS," is an impressive database providing information on smoking prevention, cigarette consumption, demographic characteristics, economics, health consequences, industry organizations, laws and regulations, and programmatic interventions for nearly 200 countries.[52] It is a collaborative effort of WHO's Tobacco-Free Initiative, the American Cancer Society, the World Bank, and the Centers for Disease Control and Prevention (CDC).

NATIONS is an outgrowth of another resource, the *Tobacco Control Country Profiles* monograph, produced by the American Cancer Society in collaboration with WHO, the International Union Against Cancer, and CDC. Covering 196 nations and territories, this resource is available online as well as in hard-copy form.[53]

The Tobacco Atlas, compiled by Judith Mackay and Michael Eriksen, concisely summarizes information on data included in NATIONS and the *Profiles* monologue, with color-coded maps showing readers the areas where the greatest intensity of male smoking is found, which countries' markets the major tobacco manufacturers control, and so on. *The Tobacco Atlas* is available from WHO in hard-copy form and online.[3]

The Global Youth Tobacco Survey provides data on youth tobacco use; attempts to expand coverage globally have now placed the survey in nearly 140 countries. Run by CDC and WHO, it also has received funding from the Canadian Public Health Agency, the US National Cancer Institute, and the United Nations Children's Fund.[54]

EXPANDING RESEARCH CAPACITY

These databases constitute tremendously important resources for low- and middle-income countries, and for the international tobacco control community, to investigate crucial questions about tobacco use and its deleterious effects and to formulate effective control policies. As discussed earlier, however, numbers alone will not create the research needed to address global tobacco control needs. Countries, especially poor countries, must have the internal resources—the people, institutional commitment, and money—to make research a viable and productive part of the tobacco control enterprise. Organizations at both the national level (in the United States, Canada, and elsewhere) and the international level (notably WHO and the World Bank) are devoting programming and money to building research capacity. Their efforts have been reviewed in detail by Lando et al.[47] and Kassel and Ross.[40]

Despite these promising resources, the capacity to engage in the research needed to diminish the burden of tobacco simply is not available in those countries most in need of such research. It is unlikely that a country such as Tanzania possesses epidemiologists able to devote their energies to studying that country's emerging tobacco disease epidemic. How many psychologists can study methods of encouraging cessation among smokers in a country such as Malawi? The research capacity is virtually null, with few prospects for altering the situation in the foreseeable future. These prospects will improve only if the international community determines a way to transfer resources, in large quantities, to where they are most needed. This probably will require the generation of new resources for building research capacity, preferably without drawing them away from other critically important public health concerns. At present, the 1 realistic prospect for such progress is the FCTC.

ROLE OF RESEARCH IN THE FCTC

The FCTC represents an attempt to bring research-based interventions and public policies, designed to tackle a major public health nemesis, into a legally binding international treaty sponsored by WHO. In February 2003, at the conclusion of 3 years of negotiations, delegates from more than 170 countries approved a final version of the treaty. In May of that year, the member states of the World Health Assembly adopted the convention. The treaty entered into force on February 27, 2005. As of March 2005, 59 countries have become parties to the treaty.

The FCTC is a fascinating and important example of both the contributions of research to global tobacco control and the very real limits as to what research can accomplish. Several observations will illustrate. First, the FCTC is a reality because thousands of scientists have built an irrefutable case that smoking is the preeminent behavioral cause of mortality devised by humankind. It is easy to lose sight of the role that research has played in bringing international tobacco control to the fore. But science was there at the beginning, and research has reinforced the case for strong international measures ever since.

Many of the central provisions of the FCTC came into being because research placed them on the agenda. The emphasis on taxation is a notable example.[34] So, too, is concern about the health consequences of environmental tobacco smoke.[55] The objective of ridding the world of tobacco advertising has a sound basis in research as well.[56]

In contrast, research did not in every case exert a significant influence on convention delegates' desires as to what was included in the FCTC. One noteworthy example was the long-standing insistence of several developing countries that the FCTC require enforcement of bans on sales of cigarettes to children. The research does not support such a policy. In the absence of virtually complete enforcement, research suggests, such bans do not decrease smoking by children much, if at all.[57,58] They find cigarettes through other avenues, including older friends, siblings, and, of course, parents. Furthermore, unless such policies are financed by adequate fines for violations, they can represent an expensive use of limited tobacco control resources. These clear messages from the existing research base did not deter the proponents of such a provision, who saw a principle in it, from lobbying long and hard for it.

Research also proved an inadequate force to compete with the economic interests of countries home to the major multinational tobacco companies. Throughout the negotiations, the United States, Japan, and Germany consistently fought strong tobacco control measures that research has established as effective. Two notable examples are comprehensive bans on advertising and bans on smoking in public places, each of which, research shows, would eat into the sales of the multinational companies.

Ultimately, the FCTC exists because research has forced the world to confront the fact that a highly profitable economic enterprise is also an incredibly deadly one. Still, and as would be expected, the final provisions of the FCTC clearly represent a mix of politics and science-based knowledge. The significant contributions of research notwithstanding, one could argue that politics trumped science when the economic stakes were sufficiently great. But the results of research were ever present in the debate that took place during the FCTC negotiating sessions. The document that emerged, and that may shape global tobacco control in the coming decades, bears the distinct imprint of the contributions of research.

A role for research in the immediate future is to develop new knowledge that will assist countries, especially developing countries, in implementing FCTC provisions and doing so in a cost-effective manner. Research programs have been designed with this objective in mind, and selected efforts are already bearing fruit.[59]

In conclusion, the needs and challenges that confront the task of making research a significant contributor to the future of tobacco control in the developing world are formidable indeed. At the same time, a nascent effort to build new resources and to share those already existing in developed countries (especially human capital) suggests that substantial challenges are not producing paralysis in the research community. What is needed now is effective education of international decisionmakers to heighten awareness of the need for and value of tobacco control research. Such an educational process will itself require resources. Notably, it will demand the commitment of the scientific community in the developed world. It also will require a

strong and sophisticated political approach to selling the message and acquiring meaningful resources. The challenge is daunting, but so too is the price of failure: tens if not hundreds of millions of avoidable premature deaths. ■

About the Author

Kenneth E. Warner is with the University of Michigan School of Public Health, Ann Arbor.

Requests for reprints should be sent to Kenneth E. Warner, PhD, Department of Health Management and Policy, School of Public Health, University of Michigan, 109 S Observatory, Ann Arbor, MI 48109-2029 (e-mail: kwarner@umich.edu).

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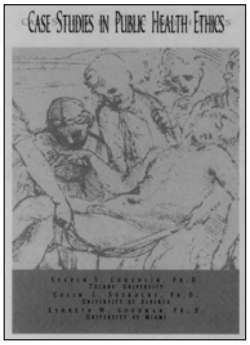

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